

CLAIMS

We claim:

- 1 1. A noble metal tip for use with a spark plug electrode, comprising:
 - 2 a firing end having a sparking surface,
 - 3 an attachment end, and;
 - 4 a retention feature extending generally radially inwardly into said
 - 5 noble metal tip, wherein said noble metal tip is capable of being inserted into a bore
 - 6 located in either a spark plug center and/or ground electrode such that said sparking
 - 7 surface is located outside of the bore and said retention feature is located within the bore.
- 1 2. The noble metal tip of claim 1, wherein said attachment end includes a
2 tapered section.
- 1 3. The noble metal tip of claim 1, wherein said retention feature radially
2 extends only partially through the diameter of said noble metal tip.
- 1 4. The noble metal tip of claim 3, wherein said retention feature is of a
2 generally conical shape.
- 1 5. The noble metal tip of claim 3, wherein said retention feature includes a
2 groove that extends around the entire circumference of said noble metal tip.
- 1 6. The noble metal tip of claim 1, wherein said retention feature includes a
2 diameter that is between 0.05mm-0.3mm.
- 1 7. The noble metal tip of claim 1, wherein said retention feature radially
2 extends into said noble metal tip by a distance that is between 0.05mm-0.3mm.
- 1 8. The noble metal tip of claim 1, wherein said tip further comprises a
2 plurality of said retention features, one or more of said features are located at a first axial
3 position along said tip and one or more of said features are located at a second axial
4 position along said tip, said first and second axial positions are spaced from one another.

1 9. The noble metal tip of claim 8, wherein first and second retention features
2 are located at said first axial position and are circumferentially spaced from one another
3 by approximately 180°, and third and fourth retention features are located at said second
4 axial position and are circumferentially spaced from one another by approximately 180°.

1 10. The noble metal tip of claim 9, wherein said first and third retention
2 features are circumferentially spaced by approximately 90°, said third and second
3 retention features are circumferentially spaced by approximately 90°, said second and
4 fourth retention features are circumferentially spaced by approximately 90°, and said
5 fourth and first retention features are circumferentially spaced by approximately 90°.

1 11. The noble metal tip of claim 1, wherein said noble metal tip is comprised
2 of an Ir-based material.

1 12. An electrode assembly including the noble metal tip of claim 1.

1 13. A spark plug including the electrode assembly of claim 12.

1 14. A center electrode assembly for use in a spark plug, comprising:
2 a center electrode component including a front end having a blind bore
3 formed therein,
4 a generally cylindrical noble metal tip secured within said blind bore,
5 said tip including:
6 a firing end having a sparking surface,
7 an attachment end located within said blind bore, and;
8 a retention feature, and;
9 a fusion layer;

10 wherein said retention feature receives at least a portion of said fusion
11 layer such that said noble metal tip is secured within said blind bore.

1 15. The center electrode assembly of claim 14, wherein said tip further
2 comprises a plurality of said retention features, one or more of said features are located at
3 a first axial position along said tip and one or more of said features are located at a

4 second axial position along said tip, said first and second axial positions are spaced from
5 one another.

1 16. The center electrode assembly of claim 14, wherein said sparking surface
2 protrudes beyond the end of said center electrode tapered front end by a distance between
3 0.1mm-1.0mm.

1 17. The center electrode assembly of claim 14, wherein said sparking surface
2 has a diameter between 0.25mm-1.0mm.

1 18. The center electrode assembly of claim 14, wherein said noble metal tip is
2 comprised of an Ir-based material.

1 19. The center electrode assembly of claim 14, wherein said center electrode
2 component is comprised of a nickel-based material having a thermal conductivity of
3 greater than 30 W/mK during normal spark plug operating temperatures.

1 20. A spark plug including the center electrode assembly of claim 14.

1 21. A method of manufacturing a spark plug electrode assembly, said method
2 comprising the steps of:

3 (a) providing a noble metal wire;
4 (b) providing either a center or ground electrode;
5 (c) drilling retention features into said noble metal wire;
6 (d) inserting an end of said noble metal wire into a recess in said
7 electrode;
8 (e) applying a laser to said electrode such that a molten material flows
9 into said retention features, and;
10 (f) cutting said noble metal wire to a predetermined length.

1 22. The method of claim 21, wherein step (c) further comprises using one or
2 more laser heads to laser drill said retention features.

1 23. The method of claim 21, wherein step (e) involves no relative motion
2 between said laser heads and either said electrode or said noble metal wire.

1 24. The method of claim 21, wherein step (c) further comprises laser drilling
2 retention features such that they only partially extend through the diameter of said noble
3 metal wire.

1 25. The method of claim 21, wherein step (f) further comprises using a
2 tapered cutting wheel to radially cut said noble metal wire to a predetermined length such
3 that one end of the cut section is flat where the other end of the cut section is tapered.

1 26. The method of claim 21, wherein said noble metal wire is an Ir-based
2 wire.